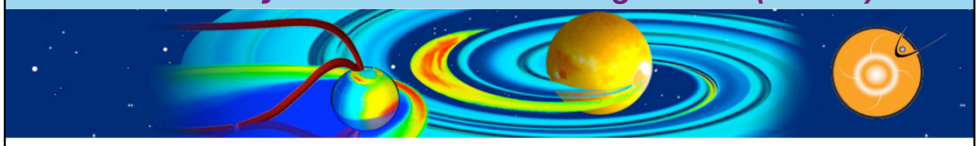
Community Coordinated Modeling Center (CCMC)



CCMC Integrated Space Weather Analysis (iSWA) System Intro & Demo

A web based tool for space weather monitoring, analysis, event studies, and system science.

Marlo Maddox, Yihua Zheng & CCMC Team

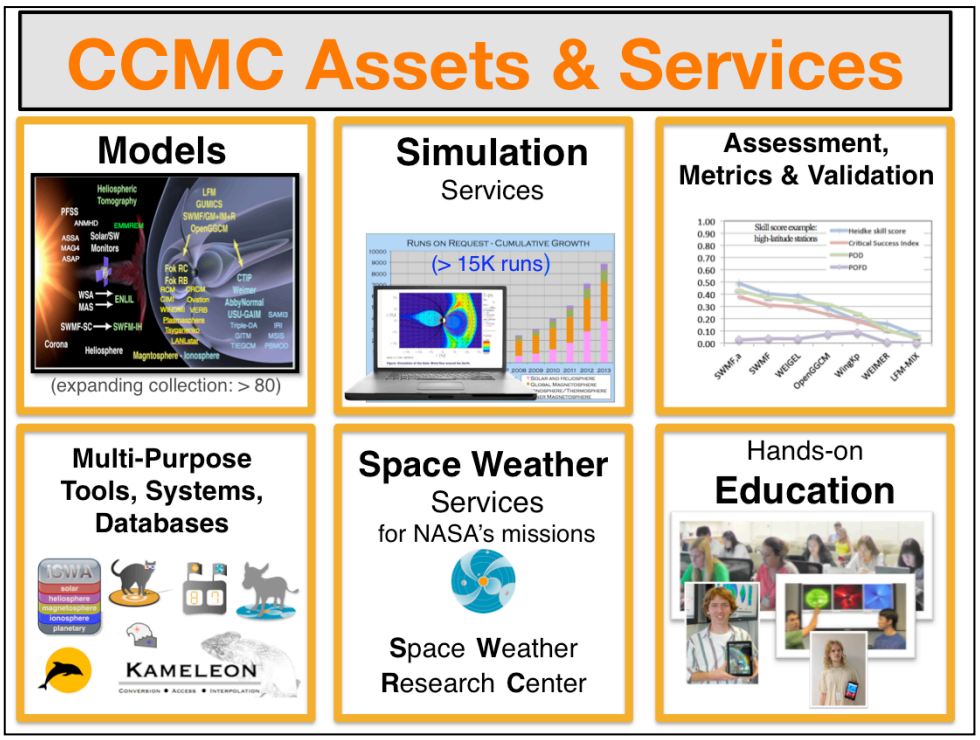
Science for Space Weather, Jan 24 – 29, 2016, Goa, India

Community Coordinated Modeling Center

- Established in 2000 as an essential element of the National Space Weather Program
- Designed to be a long-term & flexible solution to the Research-to-Operations (R2O) transition problem.

Game changing step in space weather program


Community Coordinated Modeling Center
Our vision is to continually improve space science research and forecasting capabilities, and to increase space weather knowledge and awareness.



CCMC Core Assets and Services

MODELS: The CCMC hosts a unique and expanding collection of state-of-the-art space science and space weather models developed by the international research community. As of December 2015, there are more than 80 models and model combinations that cover the entire domain from the solar corona to Earth's upper atmosphere.

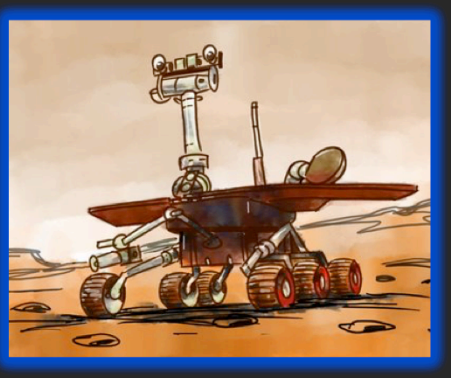
As a designated recipient of NASA Living With a Star strategic capabilities deliverables, the CCMC is expecting a significant increase in both the quantity and complexity of models within the next 3-5 year.

SIMULATION SERVICES: Models are served to the international research community

through one-of-a-kind web-based interactive Runs-on-Request (RoR) service.

- ✓ User-configurable input parameters and model settings.
- ✓ Users advising and custom simulations.

...but first,
A little
Story



In 2004, the Mars Rover Spirit experienced an anomaly…

Communication with Earth was lost for several days…

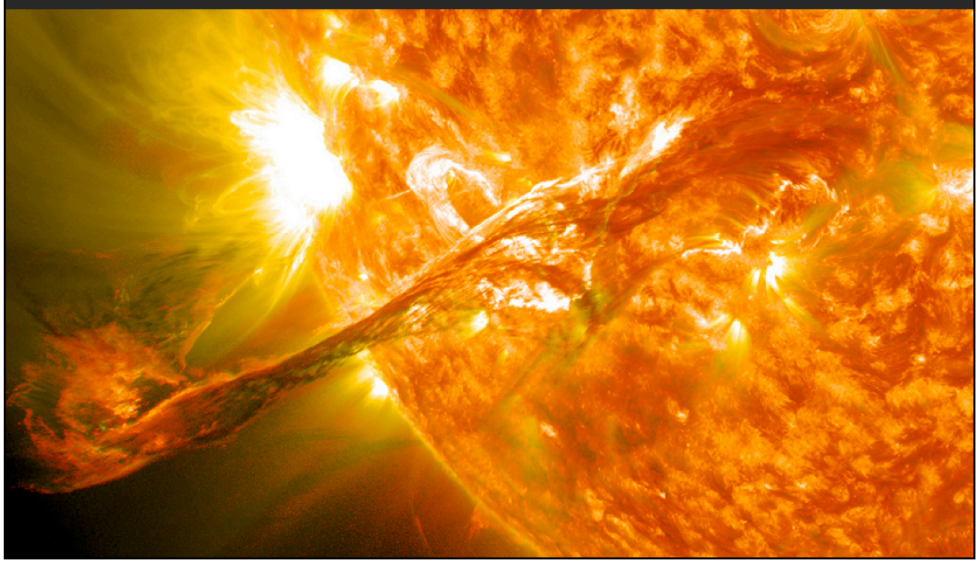
Teams scrambled to gather information.

Was this a hardware issue?

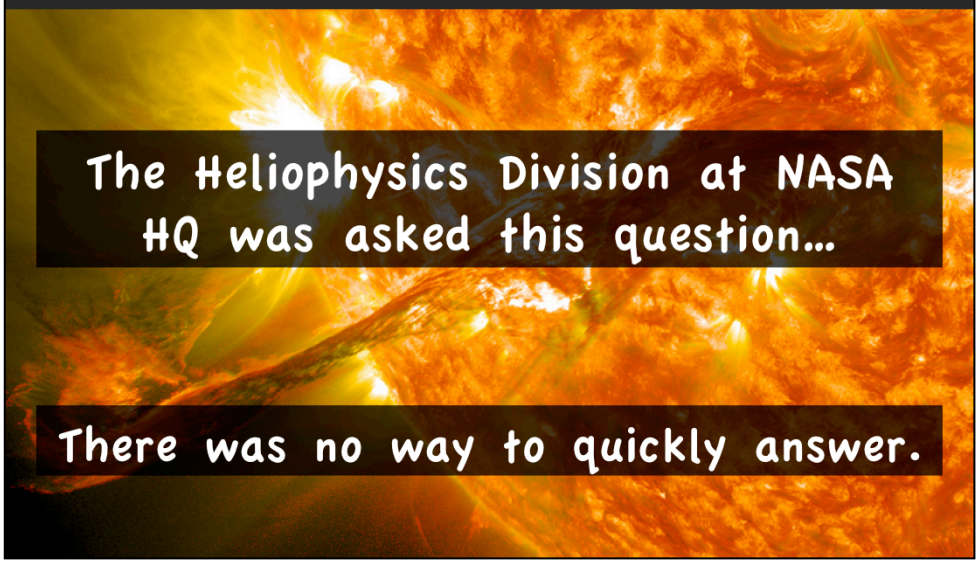
...a software issue?

Were environmental forces at play?

Was It Space Weather Related?

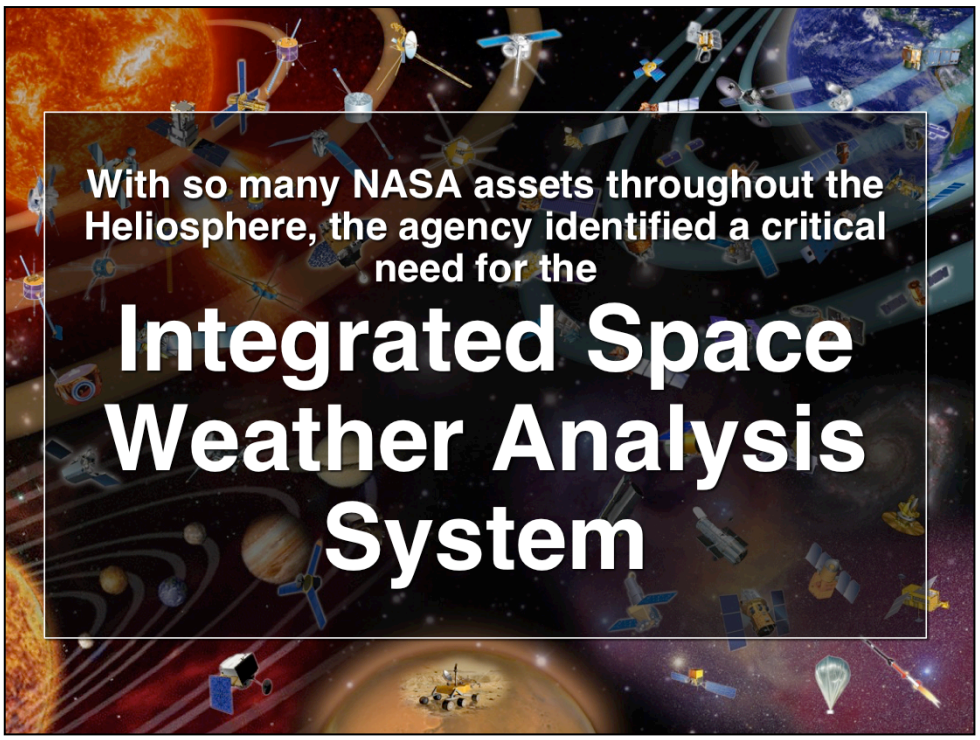


Was It Space Weather Related?



The Heliophysics Division at NASA HQ was asked this question…

There was no way to quickly answer.


With so many NASA assets throughout the Heliosphere, the agency identified a critical need for the
Integrated Space Weather Analysis System

iSWA Solution

- Acquire, ingest, and produce space weather relevant information (initial focus on NASA needs)
- Utilize both observational and simulation/model data from diverse resources
- Produce and provide real-time data streams
- Categorize and archive data for historical impact analysis
- Provide customizable and highly configurable displays
- Disseminate through the most widely deployed and accessible interface – the web
- Version 1.0 deployed November 2009

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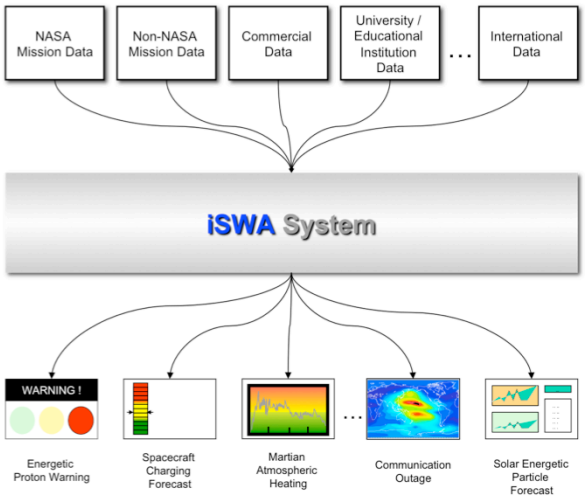
iNTEGRATED SPACE WEATHER ANALYSIS SYSTEM

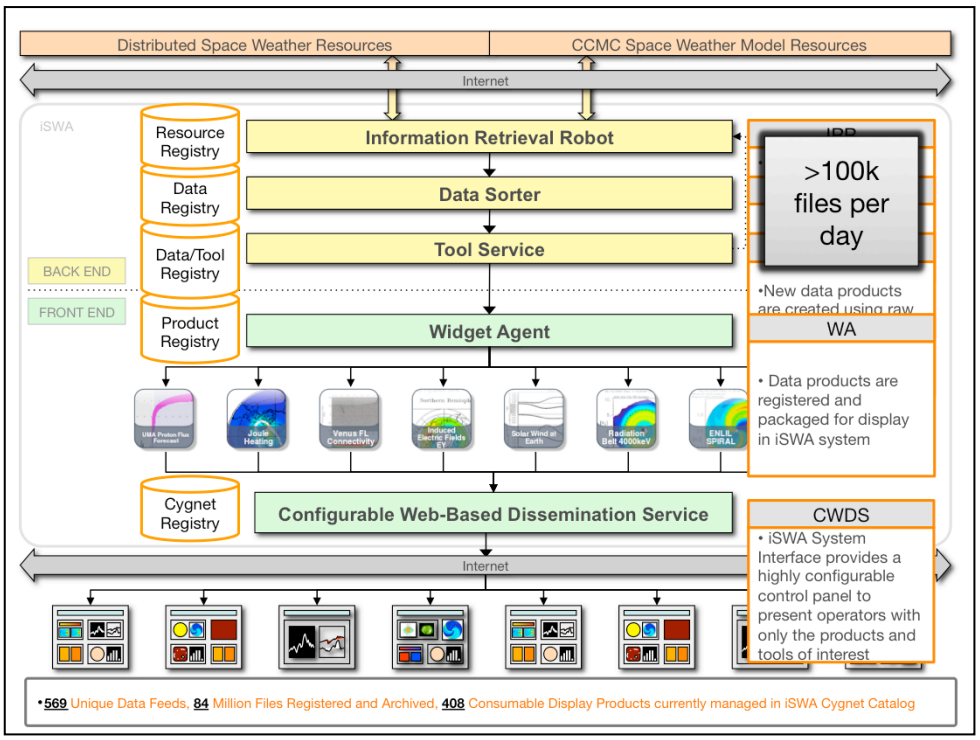


Highly diverse and distributed space weather data consisting of the latest observational data along with the most advanced space weather model simulation output.

iSWA system collects data from a large and evolving list of sources. Data is sorted, characterized, and processed into 'mission decision supporting' products in response to individual user queries.

iSWA generates and provides a user-configurable display panel that can be accessed from a standard web browser. The end user can then customize their display to focus on specific products of interest.

iNTEGRATED SPACE WEATHER ANALYSIS SYSTEM



Architectural Design Feature

All Robots Run In Parallel, currently 6 instances of each running for performance

Originality

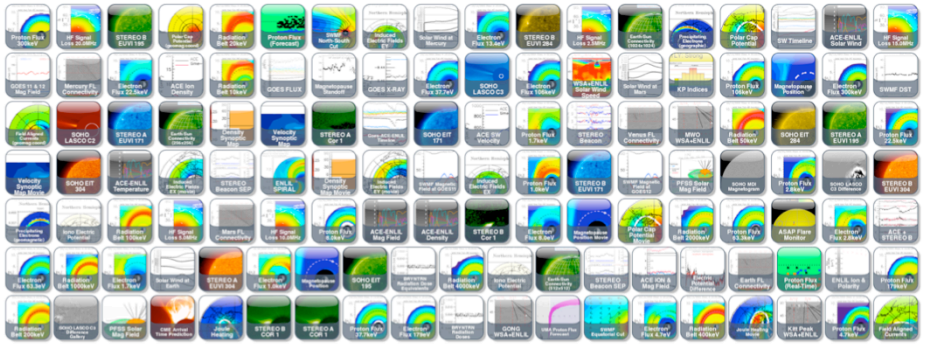
Comprehensive/custom data model
Custom interface design

Innovation

The display system
The data model and complex relationships

Innovative Dissemination

ISWA has ~500 products including modeling results and comprehensive sets of observational data.



Web-based. User configurable. Available world-wide.
One-stop shop for state-of-the-art information!
http://iswa.gsfc.nasa.gov

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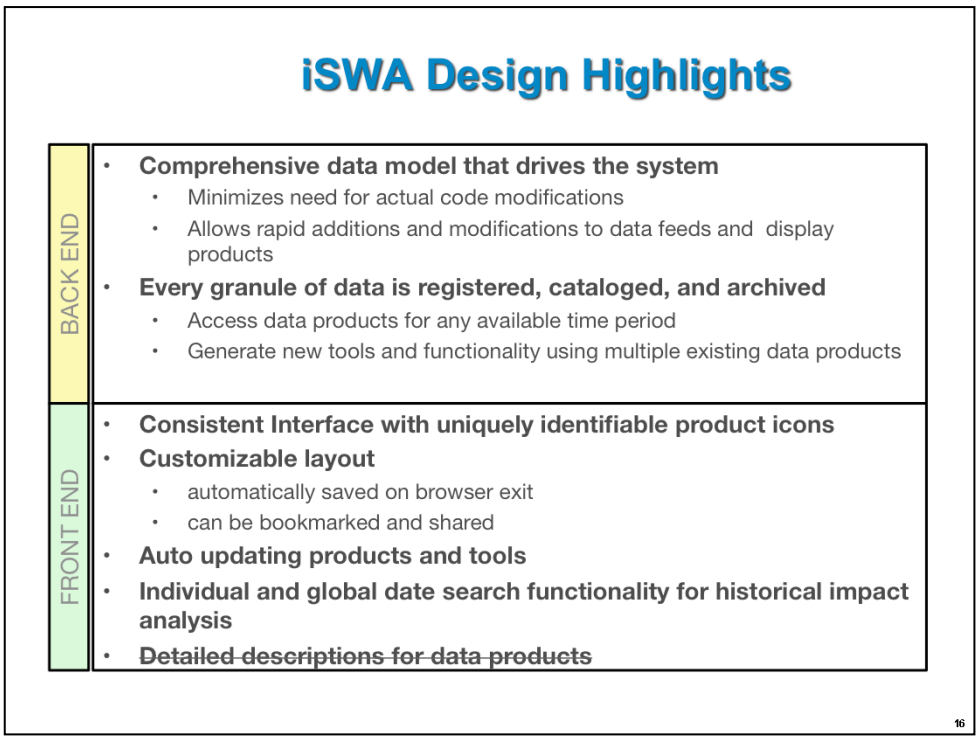


Uniqueness

1 - no other system is currently available that presents space weather data in both real-time and for historical time periods in a user flexible and configurable interface.

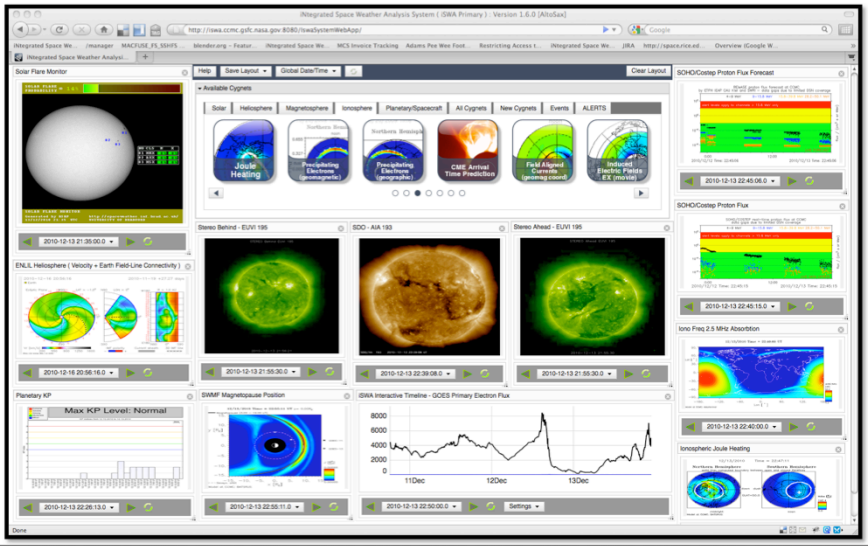
2 – system architecture is flexible enough to be applied to other applications

3 – architectural design allows for rapid additions of new content a quick maintenance of existing content

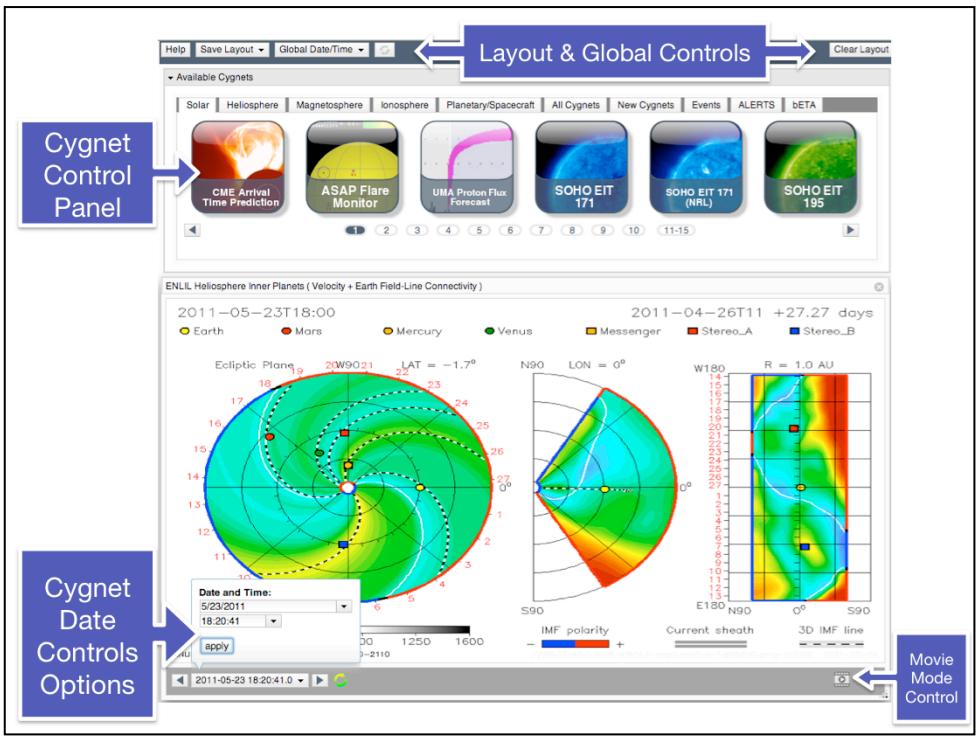
Quality

1 – backend architecture facilitates ease of maintenance, extensibility, new features.

Unprecedented Access to Space Weather Information



http://iSWA.ccmc.gsfc.nasa.gov

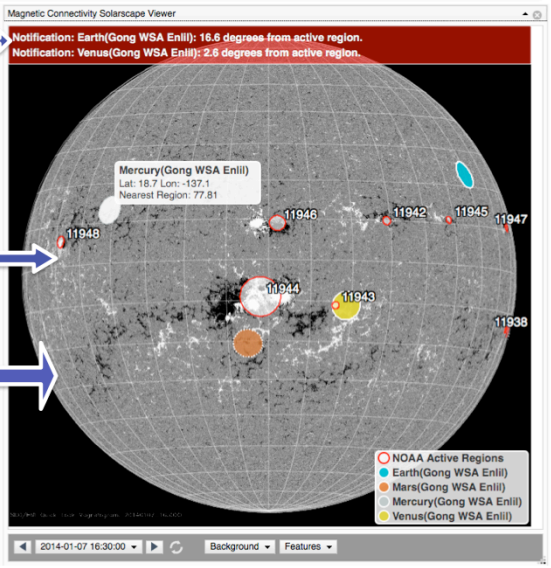

Layout & Global Controls
Cygnet Control Panel
Cygnet Date Controls Options
Movie Mode Control
Help
Save Layout
Global Date/Time
Clear Layout
Available Cygnets
Solar
Heliosphere
Magnetosphere
Ionosphere
Planetary/Spacecraft
All Cygnets
New Cygnets
Events
ALERTS
bETA
CME Arrival Time Prediction
ASAP Flare Monitor
UMA Proton Flux Forecast
SOHO EIT 171
SOHO EIT 171 (NRL)
SOHO EIT 195
ENLIL Heliosphere Inner Planets (Velocity + Earth Field-Line Connectivity)
2011-05-23T18:00
2011-04-26T11 +27.27 days
Earth
Mars
Mercury
Venus
Messenger
Stereo_A
Stereo_B
Ecliptic Plane
LAT = -1.7°
N90
LON = 0°
W180
R = 1.0 AU
S90
E180
0°
IMF polarity
Current sheath
3D IMF line
Date and Time:
5/23/2011
18:20:41
apply
2011-05-23 18:20:41.0

Dynamically Generated & Interactive Products: Solarscape

Alerts/
Notifications

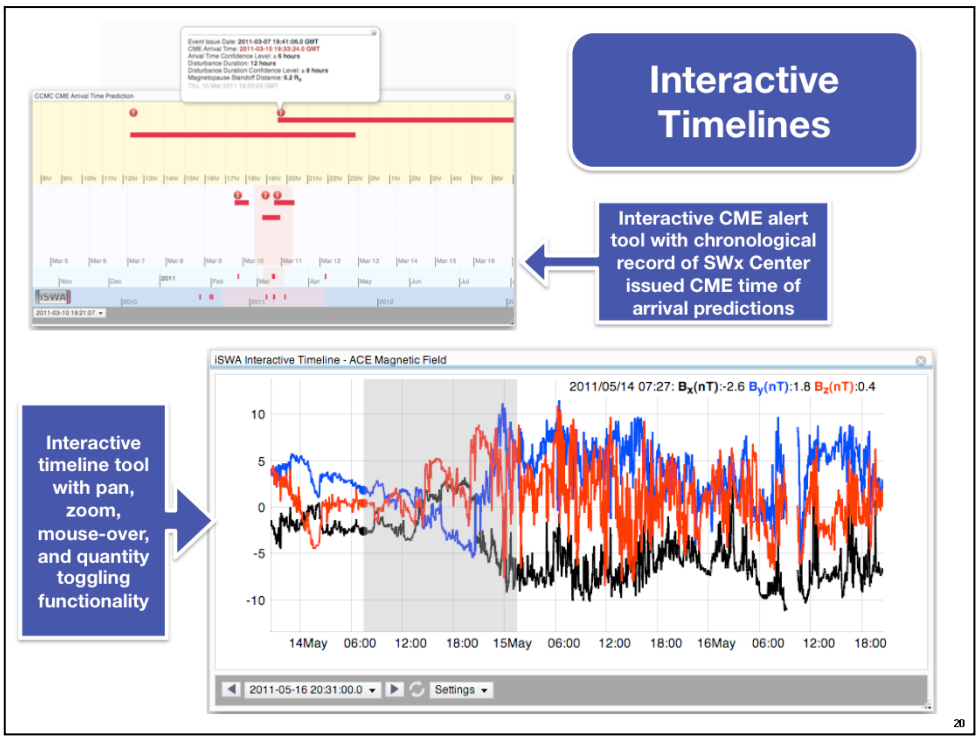
User Selectable Features
(MAG4, NOAA Active Regions,
CCMC Magnetic Connectivity)

User Selectable Background
(SDO , Generic Grid)

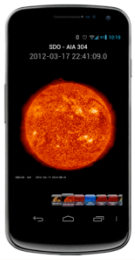


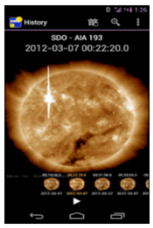
Dynamic Product with User Selectable Features From Several Sources

iSWA


Interactive Timelines
Interactive CME alert tool with chronological record of SWx Center issued CME time of arrival predictions
Interactive timeline tool with pan, zoom, mouse-over, and quantity toggling functionality
iSWA Interactive Timeline - ACE Magnetic Field
2011/05/14 07:27: Bx(nT):-2.6 By(nT):1.8 Bz(nT):0.4
10
5
0
-5
-10
14May 06:00 12:00 18:00 15May 06:00 12:00 18:00 16May 06:00 12:00 18:00
2011-05-16 20:31:00.0
Settings
20

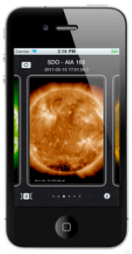
Mobile Access Powered by iSWA

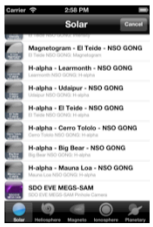


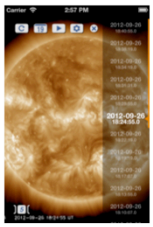


Android Front-End to iSWA

- History Mode
- Movie Mode
- >50k Downloads
- Available in Google Play Store







IOS Front-End to iSWA

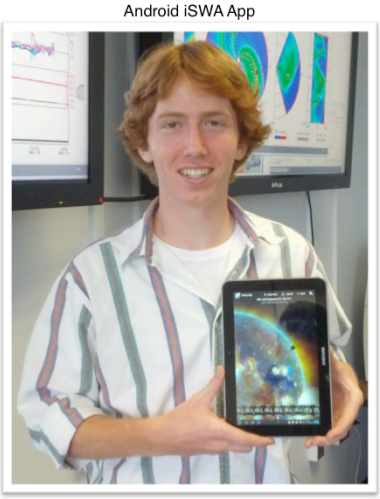
- >100k Downloads
- Available in App Store

Undergraduate Computer Science Interns SW Research Analysis Tool Development Powered by iSWA

Jack LaSota
Web-based CME Analysis Tool

CME Tool Link Sample Analysis Link

Justin Boblitt
Android iSWA App



iTunes Link Android Link

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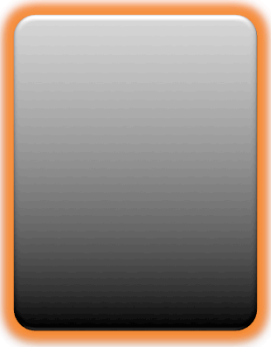
Evolution of iSWA

Development System
~2008

Production System
~2011



2nd Gen System
(Under Construction)
~2016

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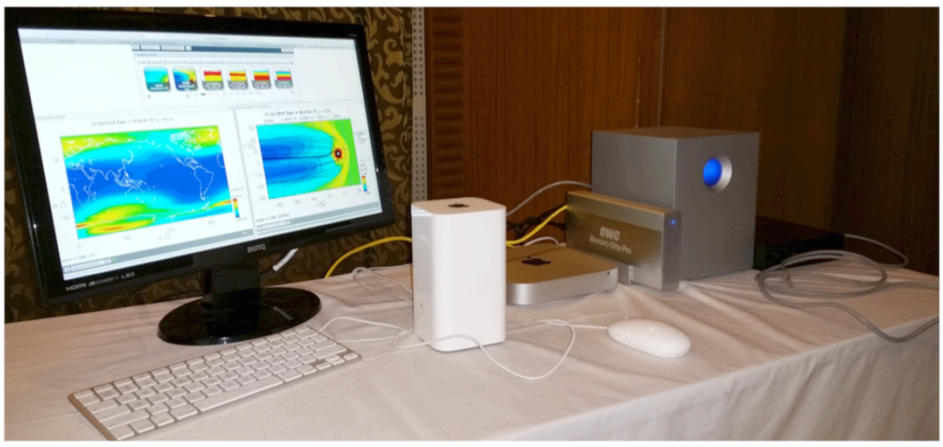
Evolution of iSWA



Iswa Portable Prototype

Deployed at Science for Space Weather Workshop January 2016, GOA, India

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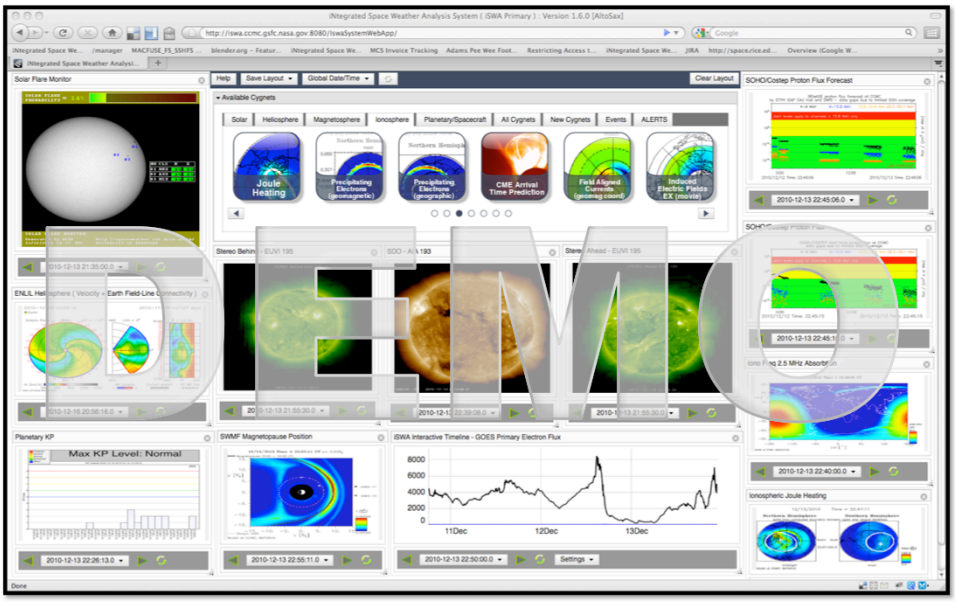

Live System at NASA (Internet): http://iSWA.ccmc.gsfc.nasa.gov
Local System/Intranet (CCMC's Wi-Fi Network): http://10.0.1.5:8080/